**Q11**

1. **Why would hardware compression be used in embedded systems?**

In embedded systems, in particular instruction compression is important as instruction storage is expensive. We reduce the most commonly executed instructions to reduce energy in embedded systems.

1. **What is the difference between lossy and lossless compression? Is Huffman coding lossless or lossy? Where else is Huffman coding used other than memory compressions?**

Lossy compression is based on a quality-of-service model, where it determines which data are critical to achieving a higher quality of service. Lossy compression greatly reduces the number of bits needed to represent data but cannot reproduce the same original quality as there is some information loss.

Lossless compression, on the other hand, requires that data be compressed and decompressed with no information loss compared to the originally compressed data.

Huffman coding is lossless as the data is recovered without any loss of information during decompression.

It is also used in Cryptography

1. **For a given five-bit opcodes as 00000, 00001, 10010, 10001, 00011, use a Huffman code to encode them. Show the Huffman coding tree and the codes for each opcode. Assume that all opcodes are equally probable.**



